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A STUDY OF THE LUMBER INDUSTRY IN IDAHO, PART II.

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A MORE FORMAL STUDY OF THE LUMBER INDUSTRY (SEE VT 002 152 AND VT 002 153) RESULTED IN IMPRESSIONS OF THE WORKERS AND WORKING CONDITIONS. THERE ARE TWO GENERAL TYPES OF EMPLOYEE--(1) THOSE VIEWING LUMBERING AS STOPGAP EMPLOYMENT WHICH SERVES AS A SOURCE OF WAGES FOR EDUCATIONAL PURPOSES OR AS AN INTERIM JOB WHILE BETTER EMPLOYMENT IS SOUGHT, AND (2) THE EMPLOYEE COMMITTED TO THIS TYPE OF WORK BECAUSE OF SOCIAL, ECONOMIC, EDUCATIONAL, OR SUCCESS REASONS. THERE IS A WIDE RANGE OF PRESTIGE AND SALARY. THE LITERATURE FROM THE UNITED STATES, CANADA, GERMANY, SPAIN, AND ENGLAND ON WORKER APTITUDES, ABILITIES, AND RELATED CHARACTERISTICS IN THE LUMBER AND PAPER INDUSTRY WAS REVIEWED AND SYNTHESIZED. TESTS OF ARITHMETIC, SPATIAL RELATIONS, INTELLIGENCE, MECHANICAL PRINCIPLES, FORM PERCEPTION, PSYCHOMOTOR TESTS OF MANUAL AND FINGER DEXTERITY, AND EYE-HAND COORDINATION HAVE RELATED SIGNIFICANTLY TO CRITERIA OF WORK SUCCESS. STUDIES BY THE AUTHOR SHOWED HIGH CORRELATION WITH WORK EFFICIENCY RATINGS FOR THREE OF NINE PERSONAL DATA ITEMS--EDUCATION, INTERVIEWER'S RATING, AND MARITAL STATUS. OF 13 PHYSICAL FITNESS, APTITUDE, AND PERSONALITY MEASURES, ONLY THE SARGENT JUMP, GENERAL LEARNING ABILITY, VERBAL APTITUDE, NUMERICAL APTITUDE, SPATIAL APTITUDE, AND MOTOR COORDINATION CORRELATED SIGNIFICANTLY (.05 LEVEL) WITH WORK EFFICIENCY RATINGS. (EM)

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A STUDY OF THE LUMBER INDUSTRY IN IDAHO
PART II

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FOREWORD

This report is Part II of a study of the lumber industry in Idaho conducted by the State Occupational Research Unit at the University of Idaho. This second part of the study dealt with certain psychological, sociological, and related characteristics of lumber workers.

Since Part I of our lumbering study was published, the Bonneville Power Administration published a report entitled Forest Industries. This report is more comprehensive than our Part I, and also contains certain data for other states adjacent to Idaho. About half of the report is composed of many tables of data which should be a valuable reference for those persons desiring rather detailed information. Those desiring a copy of the report should specify Volume II, Part 6, Forest Industries, Economic Base Study for Power Requirements. Address requests to:

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The present report is composed of two main parts. Part I is entitled "General Characteristics of Workers and Working Conditions." The contents reflect impressions and general information gained during our several weeks of research in the industry. Our coverage is not exhaustive, but we believe Part I contains enough information to correct a few misconceptions, and to give the reader unfamiliar with the industry some information of value. Part II, entitled "Worker Aptitudes, Abilities, and Related Characteristics," is more technical. It represents, for the most part, the doctoral research of the Director, Kenneth M. Loudermilk. More detail can be found in the Director's doctoral thesis, on file at the University of Idaho library (see page 28 for reference), and also available from University Microfilms, Ann Arbor, Michigan. As far as we know, this is the only source of a comprehensive review of the psychological literature relating to the lumber and paper industries. It is for this reason, rather than self aggrandizement or any claim of excellence, that the Director chose to include these research results in the present report.

PART I

GENERAL CHARACTERISTICS OF WORKERS AND WORKING CONDITIONS

Introduction

This first part of the present report is not a product of intensive research. Rather, the contents may more properly be termed reflections or impressions which resulted in the course of the other, more formal, phases of our study. This material is included for two main reasons. First, the worker characteristics discussed and the conditions described within the lumber industry should be important for anyone considering entry into the field. The choice of a job usually--probably always--involves much more than a matching of worker aptitudes and abilities with those required by the job. Second, in the course of our research, we had numerous occasions to observe working conditions and to talk with supervisory employees. We were thus able to gain a general impression of the work and related conditions within the industry. The reader should interpret the following material as suggestive, and, if personal decisions are involved, compare our statements with conditions in the local situation.

General Characteristics of the Work Force

It should be stated at the outset that there is no "typical" worker or group of workers in the lumber industry. Rather, the work force is characterized by a wide range of abilities, educational levels, etc. Perhaps the simplest explanation is to describe a few extremes which are typical of workers in the lumber industry. On the one hand, there are persons with little education and relatively low abilities who were able to enter the industry. Many lumbering jobs are fairly routine and can be performed after a bare minimum of instruction and supervision. Several of these workers probably had little opportunity to enter other types of employment, and lumbering work proved the most convenient and accessible as regards their own individual circumstances. On the other hand, there seems to be a fairly steady flow of persons of high ability and education into and out of the industry. Many persons work in lumbering a short while to obtain finances for college or other schooling. Others find lumbering a convenient "stop-gap" to pay off educational expenses before entering upon a professional line of work. Still others take advantage of the "stop-gap" nature of lumbering jobs merely to bide their time until a "more suitable" job is available.

Another pair of extremes may be described which, for ease of exposition, may be considered as lying at right angles to the two extremes described in the preceding paragraph. On the one hand, there are persons who, despite high levels of ability, have of necessity entered and remained in lumbering. These are persons who probably could have graduated from college who, through loss of a parent during childhood, illness within their family, general economic circumstances, etc. were not able to progress very far in formal education. In other words, environmental circumstances seemingly beyond their control prevented them from preparing for and entering upon other types of work. On the other hand, a few college graduates, for reasons not readily apparent, have chosen to work in lumbering on fairly routine job assignments. Others have entered lumbering intending perhaps to remain only for a short time, but an unexpected liking for the work and a few breaks promotion-wise encouraged them to remain in the industry.

The above four extremes may be considered as opposite end points of two continua pertaining to the choice process of workers entering or already engaged in lumbering employment. And they are intended to be illustrative rather than exhaustive. The motives, characteristics, etc. of any given worker logically would be a blend of the two continua, plus others of perhaps equal importance. It is evident, therefore, that the work force in the lumber industry, and the various circumstances pertaining to their employment, are fairly heterogeneous. Thus, in the paragraphs that follow, it will be necessary in most cases to give at least a two-sided picture for every aspect of lumbering work discussed.

Prestige Level of Lumbering Work

Lumbering jobs, especially production jobs in logging and mills, tend to enjoy less prestige than other occupations in, for example, the white collar field or the professional field. Several of the supervisors we interviewed were quick to point with pride to the fact that they had a son or daughter in college. A few went further to intimate that they would have chosen a different career if they had not been "trapped" in their present job due to lack of education. Several production workers told us that they felt they could "do better," the implication being that they eventually planned to enter other types of work.

There are, however, several jobs in lumbering that compare favorably with the more prestigeful occupations in other fields. There are professional occupations, such as research directors, accountants, and directors of marketing. Several office occupations are found in the larger companies, such as shipping

clerks, bookkeepers, stenographers, etc. in which both men and women are employed. Even though many jobs in logging and mill work are blue-collar types, the employees earn enough so that their purchases of housing, cars, clothing, etc. enable them to achieve a fair amount of prestige off the job and within their own immediate community. This means that persons considering a lumber career may, on the one hand, have some chance of moving into a white-collar job. On the other hand, it is very possible for the blue-collar worker, when off the job, to participate effectively in a wide range of community activities.

Salary Information

General information on pay rates in Lumbering and several other Idaho industries is contained in Table I, page 4. These figures were supplied by the Department of Employment, State of Idaho, and represent salary figures reported to the Department by a large sample of employers. Inspection of the column of wage figures for 1964 (1965 was not yet available) reveals that Lumbering is fourth in the list of twelve. Further inspection reveals that Lumbering is in fourth place for the years 1960 and 1963; during 1961 and 1962, Lumbering was fifth. A comparison of Lumbering earnings with those for Total Manufacturing reveals that lumber workers exceeded the manufacturing average for each of the five years. Disregarding Total Manufacturing (which is broken down separately into Food Processing, Lumbering, and Other Manufacturing), the industries generally fall in the following order over this five-year period: the highest in annual average weekly earnings is Construction, followed in order by Transportation, Mining, Lumbering, Other Manufacturing, Utilities, Communication, Wholesale Trade, Food Processing, Retail Trade, and Service, Hotels.

The data in Table I seem to indicate that Lumbering, being in fourth place for most of the years presented, provides a fairly acceptable wage. Indeed, this is a good source of employment for several persons with little education or training. And opportunities for exceeding the average should be recognized. Promotion from within is characteristic of many companies, and those workers with ability and the proper orientation and attitudes have a chance to move into the higher skilled or supervisory jobs. Promotion into a supervisory job, for example, can mean a wage increase of 15% to 20% above the level of those workers supervised. A few department managers receive $200.00 per week or more, which is good pay compared with most any other field of work.

Fringe Benefits

The pay rates in lumbering discussed under the previous

TABLE I

ANNUAL AVERAGE WEEKLY EARNINGS IN SEVERAL IDAHO INDUSTRIES 1960-1964

Industries	Years				
	1960	1961	1962	1963	1964
Total Manufacturing	$90.00	$90.50	$92.49	$96.56	$99.50
Food Processing	74.26	74.07	75.16	77.22	80.13
Lumbering	98.06	98.85	100.57	108.09	111.78
Other Manufacturing	95.20	99.45	103.69	106.25	110.12
Mining	103.21	105.32	107.32	110.21	114.91
Construction	120.75	124.03	135.17	144.76	151.24
Transportation	104.43	110.89	116.69	124.22	130.56
Communication	82.95	87.91	93.29	92.90	95.20
Utilities	84.58	89.40	93.19	96.14	104.72
Wholesale Trade	70.56	75.95	80.39	84.66	89.19
Retail Trade	71.78	74.64	75.35	76.83	79.17
Service, Hotels	43.90	44.48	44.41	44.93	45.98

heading are supplemented by fringe benefits in several companies. Paid holidays and vacations with pay are fairly common. Health and welfare programs are available with provisions for health, accident, and life insurance. Retirement programs also are in effect in several companies. Workers are protected by Workmen's Compensation, and all wage and salary employees are covered under the State Unemployment Insurance program.

Seasonality and Unemployment

Somewhat in contrast to the information on wages and fringe benefits is the fact that lumbering work--especially logging--is a highly seasonal industry. Although efforts have been made in recent years to provide employment for a longer period during the year, a sizeable percentage of lumber workers may expect to be out of work during the winter season. The percentage unemployed may, in some areas, run 20% or more of the work force engaged in lumbering. Winter weather, and muddy road conditions during the late fall and early spring, can hamper logging quite severely. Smaller mills, especially, which depend upon a steady supply of logs, may be forced to close down temporarily, or at least reduce their work force.

As indicated under the previous heading, wage and salary workers in lumbering are covered under unemployment insurance. This program enables most unemployed workers to receive benefits and thus improve what otherwise might be a rather meager income. A study conducted by the Department of Employment, State of Idaho, reveals the importance of unemployment insurance as an income supplement in the lumber industry. The average duration of benefits drawn by lumber workers in 1962-63 was 10.0 weeks (Employment Security Agency, 1964b, p. 24). This is only slightly under the average of 10.4 weeks for all claimants. The average weekly benefit amount was $41.00 for male claimants (Employment Security Agency, 1964b, p. 51). We might assume, therefore, that unemployed lumber workers received an average of about $410.00 from the unemployment insurance program during the 1962-63 benefit year.

Another phase of the study of unemployment insurance claimants was concerned with claimant characteristics. The results for years of education completed are interesting, and will be included here. The reader may consult the study reports if more information is desired. The study revealed that 33.2% of the male claimants completed 0-8 years of education. Another 27.1% completed 9-11 years. This suggests that unemployment may be a product of low educational attainment, and undoubtedly this is true in a number of cases. On the other hand, 39.6% completed 12 or more years of education, revealing that unemployment is by no means restricted to the poorly

educated. Separate figures were not given for lumber workers, but their educational achievements likely follow a similar pattern (Employment Security Agency, 1964a, p. 25).

Location of Employment

Many lumbering jobs, especially in logging, involve work in areas somewhat removed from centers of population. The worker may, in some cases, be away from home for extended periods of time. Life in a trailer house or in a home somewhat removed from the conveniences of city life may be necessary. Of course, modern means of transportation and communications media tend to offset such circumstances. And we should not overlook the fact that some persons might prefer just this type of life. It is possible, however, for several workers in lumbering to live in cities of several thousand population, as many mills are situated near cities several miles away from their sources of timber supply.

Size of Employing Establishments

The Idaho lumber industry contains a wide range of company sizes, ranging from no employees in the firm other than the owner to over 2,000 employees. We made a count of 584 firms in Idaho, and a few of the more important findings were as follows: 208, or 36%, had 4 employees or less; 340, or 58%, had 10 employees or less; and 27, or 5%, had more than 100 employees. During our field research, we contacted companies of all sizes, and gained certain impressions regarding how large companies differ from the very small ones. A few of the major differences will be enumerated in the next paragraph.

First, it seems that larger companies place a little more emphasis on training and "mental" aspects of the work. Larger companies tend to have a greater variety of jobs involving the use of complex machines and processes. The smaller companies tend to have a narrower scope of operation, and the emphasis is more on routine tasks and muscular effort. Second, larger companies tend to be more stable as regards year-round employment. The larger companies can stockpile enough raw material to tide them over periods when logging operations are suspended. Several small companies must close down completely during the winter months, and loggers commonly suspend operations due to inclement weather. Third, there appears a tendency for employees in smaller mills to be a "jack of all trades." That is, the worker may be expected to handle the majority of all jobs in the company at one time or another. While variety may be typical of beginning jobs in larger mills, the worker eventually tends to enter and remain in a more specialized type of work. Fourth, small employers tend to handle

their hiring and firing of workers in a rather casual manner. We do not mean that it is capricious or impulsive. Rather, it is frequently done by word of mouth and is accomplished quickly and on-the-spot according to prevailing circumstances. Larger employers are more likely to have somewhat formal interviewing procedures, personnel policies, grievance procedures, and may require written applications. Finally, large companies tend to operate under formal union-management contracts, whereas many smaller companies are non-union.

Physical Requirements of Lumbering Work

There is a great variety of jobs in lumbering as regards physical effort required. Some jobs in logging are rather heavy, as the worker must traverse fairly rugged terrain carrying a power saw and other equipment. Logging jobs, and several mill jobs, may expose the worker to all kinds of weather conditions. Many entry jobs in the mills require considerable muscular effort. Common tasks are the handling of lumber and paper products, and considerable lifting, pushing, and pulling movements involving the hands, arms, and shoulders. A standing position usually is required.

On the other hand, many lumbering jobs require only light or moderate physical effort. Even in logging there are truck, crane, and tractor operating jobs in which the worker may be seated at least part of the time. These machines usually have enclosed cabs to protect the worker from the weather. Several jobs in the mills involve machine operation which allows the worker to be seated at a control panel pushing buttons or pulling levers. And several mills have some work areas enclosed and at least partially heated during the winter. During the summer, air fans are used to keep work areas from becoming unbearably hot. It is important to note that a lack of physical exertion does not necessarily mean that the jobs do not require considerable effort on the part of the worker. Many jobs are deceptive; they look simple, but the speed and mental alertness required of the worker can be tiring over an 8-hour shift.

Employment of the Mentally and Physically Handicapped

The above discussion of physical requirements requires some comment regarding opportunities in lumbering for mentally and physically handicapped persons. Contrary to the impressions of certain individuals, lumbering employs persons with a wide variety of handicaps. Indeed, certain companies make it a practice to hire limited numbers of persons trained at recognized institutions for handicapped persons. One large company we visited has a work force including 5% or more with

some type of disability. Many companies, in addition to hiring persons with disabilities, try to re-absorb their own employees who have been injured on the job and of necessity have been absent from their work for extended periods.

It should be pointed out, however, that it is not an easy matter for a person with a severe mental or physical handicap to obtain lumbering employment. An employer must have a crew of workers most of whom are able to handle relatively complex and demanding work situations if he is to stay in business. As already mentioned, several jobs are not too demanding mentally or physically, but they usually are not those jobs that can be entered directly. Rather, they are entered after months or years of experience on other jobs which the handicapped worker may not be able to perform. Many mills, especially those with union contracts, have a specified line of progression. Therefore, they do not hire persons to fill entry jobs unless they have the potential to fill jobs much higher in the line of progression. It seems that the latter condition is an important issue for which the lumbering companies and unions together should seek a solution.

The somewhat paradoxical situation described above has important implications for those responsible for the education and placement of handicapped persons. Far too many placement efforts in the past have been charity appeals rather than an attempt to place a selectively trained individual. The point we wish to emphasize is that the training and placement of the handicapped should be concerned with an appraisal of the person's remaining abilities, and an educational program which develops the best of these abilities in a manner which prepares him for one or more fields of work. The emphasis thus shifts from placing a "handicapped worker" to the placement of a worker with some qualifications who happens to have a physical or mental impairment. The distinction perhaps seems arbitrary, but we believe it has important implications for the training and placement of the mentally and physically handicapped.

Characteristics of the Physical Environment

Lumbering operations already have been discussed briefly in relation to the physical requirements of the work, and there may be some repetition in the material which follows. The logger works in timbered areas and in country which usually is hilly or mountainous. He may be exposed directly to the weather during all seasons of the year. The work environment, plus the equipment he handles, may result in the soiling of his clothing and person with dust, mud, grease, etc. This is true also of many jobs in mills which may be considered

"dirty." There has been a trend in recent years, however, toward mechanization of many operations, especially in the mills. It is not uncommon for a worker to wear a light pair of slacks and a short-sleeve sport shirt, and to keep fairly clean during his day's work.

Another characteristic of lumbering is a considerable amount of machine noise. Saws, electric or gas motors, and moving machine parts can become almost deafening on some jobs. A few workers, after long exposure, have had some trouble with their hearing, such as a drop in acuity or in their ability to hear certain frequencies. Others apparently are able to adapt to the noise so that it does not produce any great amount of discomfort or impairment. Furthermore, earplugs have been developed and may be used for ear protection on some jobs that are extremely noisy.

Several lumber mills have stairways, ladders, and elevated walkways which require that the worker have sufficient balance and use of his arms and legs to traverse the different work areas. Some jobs must be performed in areas which do not give full freedom of movement, so that lifting, carrying, and other movements may, at times, need to be made in an awkward position. There is some danger of injury from slips, falls, and flying objects.

Several of the work operations are repetitive. For example, the worker may stand alongside a moving lumber chain doing a simple repetitive task day after day. Some persons do not mind such a job. Indeed, a few workers decline advancements into higher paying positions requiring more responsibility. Other workers prefer more variety, and may separate from their employer if they are unable to advance to more interesting work.

The work environment in lumbering tends to be fairly free of dust in the air, although a few jobs have a noticeable amount of fine sawdust which cannot be controlled. There is in most work environments, however, a certain amount of sawdust, pollen, and floor or ground dust that cannot be completely controlled. The majority of persons do not experience any ill effects, but persons with asthma and various allergies have had difficulty. A few find they cannot remain in the work and must terminate their employment.

Industrial Accidents in Lumbering

The lumber industry, engaged as it is in harvesting and processing timber, makes use of many powerful transportation and production machines. It is obvious that some danger to life and limb surrounds work operations which involve the handling of

thousands of tons of timber products. Woods workers are subject to injuries from falling limbs, trees, and logs, falls on steep mountainous terrain, and from being caught in or struck by heavy machinery. Mill workers also are subject to machine injuries and falls. The latter also may receive body sprains or strains, fractures, chemical burns, splinters, and injuries from flying objects.

The Industrial Accident Board (1964, p. 6) reported a distribution of claims according to industries from July 1, 1962 to June 30, 1964. The number of claims is given for various industries, but direct interpretation is not possible as total workers in the various industries are not given. We made some independent comparisons of these data with employment in various industries published by the Department of Employment, State of Idaho (Idaho Employment, August, 1965 and January, 1966). It appears that lumbering, mining, and construction, percentagewise, account for more industrial accidents than any other Idaho industries. It is not clear, however, which of the three is highest. All three industries involve the worker in tasks directly or indirectly associated with powerful machinery and the movement and processing of many tons of material.

But despite the danger of accidents and injuries, in recent years there have been efforts within the lumber industry to improve conditions in this respect. Several of the larger mills have full-time safety directors. Posters and other communications methods have been used to make workers more safety conscious. A few companies have given their workers bonuses in the form of a ham or a turkey if accidents are held below a certain figure for a specified period of time. More sophisticated management programs, under the title of work-risk control, have been concerned with all types of operating problems involving both men and machines--including industrial accidents. As a result of such efforts, and physical changes in the working environment, accidents and injuries have been reduced. It should be pointed out further that many of the accidents can be avoided. True, some accidents happen in spite of the best precautions, but several others occur because the worker chooses to ignore or violate fairly simple safety rules. It follows, therefore, that the accident probability in lumbering should be no serious deterrent to anyone interested in the industry, and who is willing to exercise a reasonable amount of caution and prudence in his work.

Unionization in Lumbering

As already stated previously, most large mills operate under union-management contracts. The contracts typically set forth provisions concerning wage rates, lines of promotion,

holidays, etc. Most jobs are entered via progression according to seniority. Promotions thus may be slow at times, and ambitious workers may become impatient with their slow progress. Many workers leave the industry because they become dissatisfied with the slow rate of advancement. And their departure is due many times to an opportunity to enter another, more preferred, line of work.

On the other hand, there are opportunities for advancement in lumbering that should not be overlooked. Most companies promote from within to fill their jobs. It is possible, therefore, for the worker eventually to move up to the foreman level or higher. In so doing, he moves from the hourly wage level into the salary level, and thus tends to identify more with the management group. Hourly workers do not always need to follow the seniority progression line to enter certain jobs. It is common for the company, in union agreements, to set aside certain responsible jobs for which they can select anyone they choose. Examples are graders, checkers, and leadmen in various departments. Maintenance trainees for jobs such as electrician, carpenter, millwright, etc. may enter and progress by passing certain aptitude or trade information tests. Thus, the enterprising worker may advance himself rapidly by preparing himself and applying for those jobs not in the regular seniority line of progression.

A Final Note

We hope that the foregoing material will be of some help to those responsible for guiding and educating students who may one day enter the lumber industry. While much of the material likely is rather transparent to those familiar with the industry, some of our first-hand observations may serve to correct certain misconceptions and to generally extend the knowledge of those persons unfamiliar with lumbering.

We do not claim exhaustive coverage. Hoppock (1963, pp. 20-27, & pp. 427-445), for example, presents a rather extensive list of questions which might logically be asked concerning a field of work. Our material is not this extensive in coverage. We believe, however, that it should give any interested person a fairly good appreciation of conditions within the lumber industry. Perhaps the best method is a first-hand look via a field trip (Hoppock, 1963, Chap. 14). Many companies welcome visits from interested persons, and a few have regularly scheduled plant tours. Thus, the information we have supplied may be extended to suit individual needs.

PART II

WORKER APTITUDES, ABILITIES, AND RELATED CHARACTERISTICS

INTRODUCTION

The lumber and paper industries are basic segments of the economy in many sections of the United States. A review of the research literature reveals, however, that the characteristics of workers in these industries have received relatively little study. Ghiselli (1955) made an extensive survey of the occupational validities of a wide variety of psychological tests. Both published and unpublished investigations were reviewed. Two appendixes in the monograph give average validity coefficients for different types of tests in the lumber and paper industries (Ghiselli, 1955, pp. 175-176; 204 & 214). A large number of coefficients is reported, and for several types of tests, but no details are given regarding the individual studies from which they were obtained. Correlations range in magnitude from .00 to a high of .77, the latter obtained with an arithmetic test. Other tests yielding average validity coefficients above .30 are: spatial relations, location, intelligence, immediate memory, and tapping.

We surveyed the literature for original studies and found several conducted in the United States and in certain foreign countries. Some studies involved psychological tests whereas others investigated other problems relating to worker performance. Studies in the lumber industry will be presented first in the paragraphs immediately following. Research in the paper industry will be presented next in order. This is followed by a presentation of two research studies conducted in Idaho. A short discussion of the research conducted in the lumber and paper industries completes this report.

RESEARCH IN THE LUMBER INDUSTRY

Three somewhat general studies in the lumber industry will be cited first. An early study in Germany, reported by Hilf (1930), was designed to increase the efficiency and production of lumbermen. Small crews of from two to about six men (total cases not clearly specified) were studied for periods of several day's duration. The study resulted in the setting of piece rates for timber cutting, higher production, and increased

efficiency. The United States Employment Service (Federal Security Agency, 1940, pp. 78, 146, 170, & 242) developed Oral Trade Questions for several occupations in the lumber industry. It was found possible to select questions which would discriminate between skilled persons, apprentices, and novices for various types of cranemen and derrickmen in sawmills, various types of firemen on logging equipment, and wood pattern makers in planing mills. Moreira (1953) published an article pertaining to the recruitment and selection of workers for the lumber industry in southern Brazil. No experimental work was reported. Rather, the article is a general treatise on several areas of industrial psychology, and their implications for this section of Brazil.

Four studies utilized different types of psychological tests. Lamich (1947) reported a study conducted in Spain of 75 accident victims in the wood industry. The article contains considerable data, but there was very little analysis to facilitate interpretation. Tests of mechanical intelligence, memory for forms, motor coordination, and reaction time were administered. Quartile distributions of the scores were prepared and were presented in tables comparing them with norms previously developed. Inspection reveals that the largest percentages of the accident victims scored in the lowest quartiles, or in the two lowest quartiles.

Stewart's (1947) analysis of the performance of Army personnel on the Army General Classification Test included two occupations of interest here, namely, woodworking machine operator and lumberjack. A total of 227 occupations was ranked according to median test scores. The woodworking machine operators, numbering 206, received a rank of 186 and a median score of one hundred. The latter score was at about the forty-second percentile. The lumberjacks, numbering 236, received the lowest rank of 227, with a median score of 85, approximately the twenty-first percentile. A comparison of the World War II lumberjacks with a similar group tested with the Army Alpha during World War I revealed essentially similar percentiles for the median scores.

The General Aptitude Test Battery (United States Department of Labor, 1958) was administered to 59 men employed as woodworking machine operators in Pennsylvania. The criterion was supervisory ratings. Validation studies with the General Aptitude Test Battery result in the development of a multiple cut-off profile of at least two and as many as four scores selected from the nine factor scores of the test battery. Correlation coefficients then are computed from a four-cell table formed by passage and failure on the multiple cut-off profile as related to a two-part division of the criterion ratings into

"good" and "poor" workers. The study yielded a multiple cut-off profile based on General Learning Ability, Numerical Aptitude, Finger Dexterity, and Manual Dexterity. The tetrachoric correlation was .79 with a .22 standard error.

Gough (1961) reported an unpublished study in which the Personnel Reaction Blank was administered to 46 lumber mill employees in Montana. A correlation of -.41 was obtained with ratings of work effectiveness--negative because the test was scored so that higher scores represented poorer performance.

Several studies have dealt with body functions or characteristics of lumber workers. Fortier (1946) conducted a study in Quebec, Canada, in which 12 occupational groups were tested for physical efficiency. The Step Test was administered, which yields an index of physical efficiency based on the recovery pulse rate. Cases in the 12 groups ranged from 4 to 108 persons. Fortier was able to order the 12 groups according to increasing physical efficiency, from watchmen, who had mediocre physical efficiency, to baggage carriers, who displayed excellent physical efficiency. The study by Fortier was the only one of this group which seemed concerned primarily with studying and comparing occupational groups. The remaining studies, one in Sweden and the remainder in Finland, seemed to emphasize certain physiological and nutritional characteristics, or involved medical tests, and will be cited only for reference purposes (Karvonen, 1962; Karvonen, et al., 1961a; Karvonen, et al., 1961b; Karvonen & Turpeinen, 1954; Lundgren, 1946; Rautaharju, Karvonen, & Keys, 1961).

RESEARCH IN THE PAPER INDUSTRY

Research in the paper industry perhaps had its beginning when Hirsch (1935, 1936a, 1936b, 1936c) conducted a study in a paper mill in Italy involving workers in three different jobs. Several psychological tests were administered, either European in origin or developed specifically for the study. Unfortunately, the numbers of workers tested were small, and there was little analysis of the data. The jobs, and the numbers of workers tested, were: pulp machine regulator, 12 workers; paper inspector, 18 workers; and paper machine controller, 24 workers. Composite scores on the psychological tests, ranging from motor and tactile discriminations to mechanical intelligence, were compared with rankings of the workers based on supervisory ratings. Inspection of tabled data in the articles reveals, for the most part, a perfect correlation between test performance and ratings. Another foreign study, somewhat similar in design, was conducted about this same time. Hearnshaw

(1937) conducted a study of 18 female paper sorters. The location is not given, but presumably the study was conducted in England. Tests of motor, tactile, and visual ability were administered and related to a quantitative work criterion. A dexterity test yielded a correlation of .70, and a multiple correlation of .71 was obtained.

Three studies may be cited which, while conducted in the paper industry, were not concerned with relating psychological measurements to a work criterion. Benge (1940) reported the development of the Factor Comparison System in a paper mill which previously had used a point system for setting wage rates. The company adopted the new plan, and noted certain desirable results, such as stabilized labor costs and greater employee satisfaction. Lawshe and Wilson (1946) applied multiple correlation and factor analysis to the Factor Comparison System in a paper mill. It was demonstrated that an abbreviated scale would yield results very similar to the original Factor Comparison System. Bennett and Wesman (1947) reported a study conducted in a paper company in Georgia. Several psychological tests were administered to over two thousand workers. The main purpose was to develop norms. There is no indication that the scores on any of the tests were related to a criterion of work performance.

Several studies reported during the 1940 decade gave correlations of various psychological tests with work performance criteria. Tiffin (1942) refers briefly in his book to a test validation study involving 47 paper machine operators. A correlation of .47 was obtained between the Bennett Test of Mechanical Comprehension and foremen's ratings of job performance.

Jurgensen (1943) conducted a study in a pulp and paper mill in which the Ziegler revision of the Minnesota Rate of Manipulation Test was extended by the addition of seven measures. The added tests were variations of the two original placing and turning tests, such as placing and turning with each hand alternately. A total of 212 men was tested. Test results of 60 men hired as converting machine operators were correlated with supervisory ratings. Correlations ranged from .029 to .572 for the nine measures. A maximum multiple correlation of .660 was obtained which was considerably higher than the multiple correlation of .461 which resulted from the two original tests. When the additional 152 subjects were added who had been tested but placed on other jobs, a maximum multiple correlation of .718 was obtained, based on five measures, as compared with a multiple correlation of .466 based on the original two tests.

Tiffin and Lawshe (1943) conducted a study in which they constructed the Adaptability Test and validated it on 88 clerical employees in a paper mill. Supervisors divided the employees into two groups according to job performance. Both Forms A and B of the Adaptability Test were administered, and were scheduled so that about half of the group took Form A first and the other half took Form B first. Bi-serial correlations were as follows: Form A, .40; Form B, .56; the first test given, regardless of form, .59; and .65 for the second test given, regardless of form.

Wirt and Leedke (1945) conducted a study in a pulp and paper mill in which a vision test, the Bausch and Lomb Ortho-Rater, was administered to the employees. Two groups of paper machine operators, numbering 52 each, were matched and compared. The results showed that, of 59 employees who met all visual standards, 22, or 37%, had had serious accidents. The 45 employees who did not meet all visual standards included 30, or 67%, who had had serious accidents. A second comparison involved two groups of millwrights and other tradesmen (not specified). The results showed that, of 47 employees who met all visual standards, 30, or 64%, had had two or more serious accidents. The 47 employees who did not meet all visual standards included 38, or 81%, who had had two or more serious accidents.

Research since 1950 includes one doctoral dissertation and several validation studies with the General Aptitude Test Battery. Grohsmeyer (1954) conducted a validation study of the Wonderlic Personnel Test, Form D, and the Bennett Test of Mechanical Comprehension, Form AA. At least 246 paper mill employees were tested and later employed. A total of 88 jobs was classified by company officials into three skill levels. The workers were rated by supervisors using a paired comparisons method. No significant differences between test score means were found for the different job skill levels. Correlations between test results and ratings by immediate supervisors were significant only at the highest, or skilled, job level: .26 for the Wonderlic, significant at the .05 level, and .29 for the Bennett, significant at the .01 level. A multiple correlation of .34 was obtained.

The General Aptitude Test Battery, cited above in the studies in the lumber industry, was administered in four test development studies in the paper industry. The first two studies (United States Department of Labor, 1956a & 1956b) were conducted together, and involved 53 men tested and hired as scrapper (paper goods), and 52 men tested and hired as take-off man (paper goods). The criterion was supervisory ratings. The multiple cut-off profile was composed of scores on Form Perception and Manual Dexterity for both occupations. The tetrachoric correlation for

scrapper (paper goods) was .68 with a .24 standard error, and for take-off man (paper goods) .92 with a .28 standard error. The third study (United States Department of Labor, 1957) involved 59 women employed as paper sorter and counter. Supervisory ratings served as the criterion. The multiple cut-off profile was composed of scores on Form Perception, Motor Coordination, Finger Dexterity, and Manual Dexterity. A tetrachoric correlation of .83 was obtained, with a .22 standard error. The fourth study (United States Department of Labor, 1958) was a composite of several types of bagging machine operators, 54 men and 1 woman. Supervisory ratings served as the criterion. The multiple cut-off profile was composed of scores on Spatial Aptitude, Form Perception, and Manual Dexterity. A tetrachoric correlation of .85 was obtained, with a .23 standard error.

RESEARCH IN THE IDAHO LUMBER INDUSTRY

Loudermilk (1964, pp. 88-90) administered the Thurstone Temperament Schedule to 435 beginning workers in a combined lumber and paper mill. This study was preliminary to the more comprehensive study which is presented below under a series of headings. The criterion was a work efficiency rating by foremen of either satisfactory or unsatisfactory. The seven separate scores yielded the following phi coefficients: Active, .03; Vigorous, .00; Impulsive, -.10; Dominant, .02; Stable, .07; Sociable, -.06; and .05 for Reflective. Certain personal data were taken from the employee application record and were used to compare 55 outstanding employees and 58 undesirable employees. Frequency comparisons suggested that the following might serve to identify outstanding employees: Age, 30 years or older; Education, 12 years or more; Dependents, 3 or more; Job Skill Level, skilled in some trade or occupation; and Marital Status, married. The working relationships established with company officials, and the experience gained paved the way for a more comprehensive study which now will be reported.

Problem

This study was conducted in the Clearwater Unit of Potlatch Forests, Inc., Lewiston, Idaho, a manufacturer of lumber and paper products. The plant employs an average of slightly more than two thousand employees. The basic purpose was to relate certain personal data and performance on various tests to job performance, and to assess their potential value for employee selection. The problem may be stated as one major question: "Is it possible to predict significantly, at the time of initial employment, the subsequent job performance of workers in this industrial plant from measures of aptitude, personality,

and physical fitness, and certain data obtained from an employee application record?"

Method

Prospective employees were tested periodically in small groups as they applied for employment. The testing began late in the summer, and continued over a period of nearly one year. Thus, the persons hired were considered representative of one fall and one spring hiring season. As the applicants completed the test battery, they were referred to the company personnel office where they completed an employee application record, and were interviewed by a hiring official. The hiring official was not given any test results, but had ready access to the application record.

A total of 570 male applicants completed all or part of the test battery. Of this number, 48 were hired, but for various reasons their data were eliminated from the analyses. Another 84 persons did not complete all parts of the test battery because certain test materials were not available until several weeks after the testing was begun. Thus, the important analyses were based on 130 non-hires, 96 employees who worked less than three months, and 212 employees who worked three months or longer.

A total of 23 predictors was obtained, 13 from a test battery, and 10 from the employee application record. The test battery included five physical fitness tests assembled by Mathews[1] specifically for the study. Six physical fitness scores were obtained, as follows: Sits (two-minute sit-ups), Dips (dip-ups on parallel bars), Chins (chin-ups on gymnastic rings), Jump (the Sargent jump), Run (a one hundred yard shuttle run), and a Multiple Fitness Index (an unweighted composite based on the preceding five measures). Parts of the General Aptitude Test Battery (United States Department of Labor, 1962, pp. 14-15) were administered which yielded scores on the following six factors: General Learning Ability, Verbal Aptitude, Numerical Aptitude, Spatial Aptitude, Motor Coordination, and Manual Dexterity. Scores on the remaining three factors of Form Perception, Clerical Perception, and Finger Dexterity were not obtained due to lack of time. A single score was obtained

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[1]Dr. Donald K. Mathews, at the time this study was initiated, was Research Director, Department of Physical Education, Washington State University, Pullman, Washington. He is presently Professor and Coordinator of Research in Physical Education, The Ohio State University, Columbus, Ohio.

from the Personnel Reaction Blank, a short personality test developed by Gough (1954), designed to assess the "dependability-conscientiousness" personality factor. An employee application record yielded 10 items, as follows: an Interviewer's Rating (above average, average, or below average), Age, Height, Weight, Physical Condition (pertaining to presence of impairments), Marital Status, Number of Dependents, Years of Education, Veteran Status, and Job Skill Level (unskilled vs. semi-skilled or higher, based on prior work history).

Testing was begun in 1956, and criterion data through December 15, 1962 were available. Thus, the study was longitudinal in design, covering a period of more than six years for several workers. No divisions were made regarding the type or level of work performed. Rather, the criteria were assigned across many different jobs and skill levels, and might be characterized more properly as criteria of job performance with the company. Four criteria of job performance were selected. Work Efficiency Ratings were obtained for each employee who worked three months or longer. Ratings of Outstanding, Average, Below Average, and Undesirable were assigned, based on a combination of foremen's ratings and information obtained from personnel records and company officials. Job Tenure was computed in calendar days of employment. Time Loss, as a percentage of Job Tenure, was compiled from absences due to the following: personal sickness, non-industrial accident, absence without official leave, penalty lay-off (disciplinary), sickness due to intoxicants, and similar miscellaneous causes. Industrial Accidents were identified as those resulting in medical treatment, absence from work, and insurance claims.

Results

The most significant results were obtained with the criterion of Work Efficiency Ratings, and these will be presented in some detail. The results for the remaining three criteria were mostly non-significant, and will be presented in summary form.

Work Efficiency Ratings. Correlations between the 13 scores of the test battery and Work Efficiency Ratings are presented in Table II, page 20. Pearson product-moment and tetrachoric correlations are presented to illustrate a notable difference between these two correlation methods which emerged early in the study. The Pearson correlations were computed on a desk calculator from individual test scores and numerical values assigned to the four criterion categories, as follows: 4 for Outstanding, 3 for Average, 2 for Below Average, and 1 for Undesirable. The tetrachoric correlations were computed according to Davidoff and Goheen (1953). The Pearson

TABLE II

CORRELATIONS BETWEEN PHYSICAL FITNESS, APTITUDE, AND PERSONALITY MEASURES AND WORK EFFICIENCY RATINGS

Predictor	Pearson r	Tetrachoric r
Sits	-.01	.00
Dips	.04	.24
Chins	.03	.14
Jump	.18	.20
Run	-.15	-.16
Multiple Fitness Index	.10	.12
General Learning Ability	.30	.50
Verbal Aptitude	.25	.35
Numerical Aptitude	.31	.40
Spatial Aptitude	.17	.22
Motor Coordination	.30	.47
Manual Dexterity	.12	.22
Personnel Reaction Blank	-.33	-.38

Significance levels (Pearson r): .14 = .05 level.
.18 = .01 level.

correlations, with a standard error of about .07, tend to be lower than the tetrachoric correlations. Several of the correlation pairs are quite similar, but the tetrachoric correlations for Dips, General Learning Ability, and Motor Coordination are more than two standard errors higher than the Pearson correlations. Furthermore, the writer found that the addition of a few cases would result in greater variations in the resulting tetrachoric correlations than in the Pearson correlations. Inspection of the score distributions suggested that the tetrachoric correlations for General Learning Ability and Motor Coordination were spuriously high, and the Pearson correlations were accepted as representative of the true relationships.[2]

The Pearson correlations in Table II include six, or nearly half, which are significant at or beyond the .01 level, and an additional two which are significant between the .05 and .01 levels. The negative correlation for the Run resulted from a time score. The negative correlation for the Personnel Reaction Blank reflects a reversal of the scoring key from the usual order.[3] A multiple correlation of .43 (standard error .06) was obtained, using the Wherry-Doolittle Test Selection Method. The three tests selected, in order, and their Beta coefficients are as follows: Personnel Reaction Blank, -.255; Numerical Aptitude, .169; and .162 for Motor Coordination.

Correlations between the 10 personal data items and Work

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[2]A small independent study by Loudermilk lends further support to this method of computing Pearson r's. A commonly-used intelligence test was administered twice, with an interval of three months, to 153 seventh grade students (78 boys and 75 girls). Machine correlations based on individual IQ's were .89 between the first and second verbal IQ's, and .65 between the verbal and nonverbal IQ's on the first testing. Then one set of the IQ's was divided as evenly as possible into quartiles, and all IQ's were converted into the numbers 4, 3, 2, and 1, from the highest through the lowest quartile. The machine correlation of .89 dropped to .83, and .65 dropped to .61, roughly half the .08 standard error. Thus, the Pearson r's in Table II underestimate slightly the true relationships, but they are sufficiently close so that corrections did not seem necessary.

[3]The scoring of the Personnel Reaction Blank used in this study was one in which higher scores are indicative of less dependability and conscientiousness. Since these data were collected, the Personnel Reaction Blank has been revised slightly, and is now scored so that higher scores are indicative of greater diligence, dependability, and conscientiousness.

Efficiency Ratings are presented in Table III, page 23. The correlations for Height, Weight, Education, and Age are Pearson correlations. The remaining five are contingency coefficients computed from chi-squares. The personal data item of Physical Condition is omitted from Table III, as there was an insufficient number with a physical impairment for computation of a chi-square. The significant correlation for Interviewer's Rating indicates that the company hiring officials were able to predict, barely better than chance, the future job performance of the workers. The significant correlation for Marital Status indicates that married workers had a slight tendency to receive higher Work Efficiency Ratings. Neither correlation is high enough, however, to represent a relationship of practical importance. The Pearson correlation for Education is the highest obtained in the study. Education was combined with the Personnel Reaction Blank, Numerical Aptitude, and Motor Coordination (see preceding paragraph) for multiple correlation analysis. A multiple correlation of .42 (standard error .06) was obtained. Thus, Education did not increase the multiple correlation, and its relationship with the criterion seems largely accounted for by the other three predictors.

Job Tenure. The test battery and personal data yielded the following correlations with Job Tenure: Sits, -.14; Personnel Reaction Blank, -.15; Height, -.16; and .18 for Dependents. All are significant between the .05 and .01 levels, but they are too low for practical significance. Simple analysis of variance was applied to determine if there was a significant difference between the non-hires, those employed less than three months, and those employed three months or longer. Only the Run and the Multiple Fitness Index yielded F ratios significant between the .05 and .01 levels. Inspection of the score distributions indicated that there were no differences of practical importance.

Time Loss. A comparison of a group of 37 employees with excessive (beyond 3 per cent) undesirable absences with a group of 37 employees with no undesirable absences yielded significant t ratios of 2.28 for Education and 2.55 for the Personnel Reaction Blank. Chi-squares, significant beyond the .01 level, were obtained for Veteran Status and Job Skill Level. More years of education, desirable personality, prior military service, and prior work experience above the common labor level were found more often in the group with no Time Loss. The overlapping was marked, however, revealing little of practical importance.

Industrial Accidents. Industrial Accidents were identified for 36 employees. Analysis was difficult, as there was no satisfactory basis for comparison for this group. Comparison of

TABLE III

CORRELATIONS BETWEEN PERSONAL DATA AND
WORK EFFICIENCY RATINGS

Predictor	r
Height	-.02
Weight	.03
Education	.34**
Age	.12
Interviewer's Rating	.16*
Dependents	.13
Marital Status	.15*
Veteran Status	.02
Job Skill Level	.13

*Significant beyond the .05 level.
**Significant beyond the .01 level.

the accident group with all remaining employees who had worked three months or longer yielded a t ratio of 2.19 for Age. Since the means for both groups were under 30 years of age, and the overlapping was extensive, the result for Age is of no practical importance. Further analyses revealed that the group of accident victims was quite heterogeneous, resembling closely the total group of employees on Work Efficiency Ratings, performance on the test battery, and on personal data.

Discussion

Several aspects of this study deserve some further comments. Perhaps the most controversial characteristic of the study design was the decision to base the criteria on performance in a wide variety of jobs. This was found necessary because the policy of the company was to hire men and place them as needed in several departments. This required considerable shifting among departments which was accentuated further by economic fluctuations. The correlations with Work Efficiency Ratings likely would have been higher if it had been possible to study single jobs, and perhaps different patterns of validity coefficients would have emerged. On the other hand, it seems important that highly significant correlations were obtained with Work Efficiency Ratings based on a number of jobs. This finding indicates that selection tests can have considerable value even in those situations in which policy or necessity require placement in a wide variety of work situations.

The results obtained with the General Aptitude Test Battery are consistent with results in hundreds of other studies with this test battery. It should be pointed out, however, that the use of single tests from the General Aptitude Test Battery, as in this study, is not the accepted procedure (United States Department of Labor, 1962, pp. 39-47). The omission of tests for Form Perception, Clerical Perception, and Finger Dexterity was arbitrary, and it is likely that these factors would relate significantly to performance in several jobs in the lumber and paper industries. The procedure followed by the United States Department of Labor requires the administration of the entire test battery, and the development of a multiple cut-off profile selected from the nine factor scores. On the other hand, the test manual (United States Department of Labor, 1962, pp. 63-100) gives Pearson product-moment correlations between the individual aptitude factors and many job performance criteria. The results of the present study compare favorably with many of the correlations presented in this section of the test manual.

The results for the physical fitness tests and the personality test are perhaps different from logical expectations. Physical fitness tests might be expected to relate significantly

to performance in the lumber and paper industries, as many jobs require considerable physical exertion. Perhaps the low relationships resulted because the tests used are not good predictors of physical performance over long periods of time. Better results might be obtained with a test based on the recovery pulse rate (Fortier, 1946), or heart rate might be checked periodically on the job and the results related to subsequent job performance (Brouha, 1960, p. 88). The Personnel Reaction Blank exceeded all of the other tests in predictive power. The aptitude tests, especially, might have been expected to show higher relationships. An empirically developed instrument, the Personnel Reaction Blank proved markedly superior to the Thurstone Temperament Schedule. The latter is a factorially developed instrument which was administered in an earlier study in the same plant (see page 17).

The low relationships obtained with the remaining three criteria were not difficult to explain after some inspection of the data. Job Tenure at the plant was subject to many influences. Some men quit fairly soon for other work, and a few were discharged for various reasons. On the other hand, several outstanding employees left for better jobs. Apparently those leaving at different times were a representative cross section of all employees. Time Loss appeared to need more refinement as a criterion so that absences for a variety of reasons would not be grouped together. This was not done because very few absences occurred for the majority of the workers, and thus it was difficult to derive a stable criterion measure. The Industrial Accidents were spread over a wide range of departments, jobs, and ability levels. This suggested that many of the accidents "just happened," and were not due to identifiable characteristics of the workers.

GENERAL DISCUSSION AND CONCLUSION

Despite a number of studies cited in this Part II of our report, it is obvious that much additional research would be necessary to provide a professional counselor or vocational educator with useful and relatively complete information. There are hundreds of jobs in lumbering, and studies are needed to determine desirable worker characteristics for individual jobs --or at least in clusters of similar jobs. The studies completed thus far in Idaho are rather general, relating to overall success in a large lumber and paper mill. Characteristics of workers in logging and in small mills may differ in important ways. In short, all of the research completed to date is only suggestive of those characteristics which may be desirable in lumbering.

On the other hand, in the absence of any better information,

a professional counselor should be able to make some use of this research. Perusal of the various studies indicates that tests of arithmetic, spatial relations, intelligence, mechanical principles, form perception, psychomotor tests of manual and finger dexterity, and eye-hand coordination have related significantly to criteria of work success. The Differential Aptitude Tests, presently administered in the state testing program in Idaho, includes several of these measures. The Personnel Reaction Blank is adapted from the more comprehensive California Psychological Inventory, in which it corresponds to the Socialization scale. This suggests that the California Psychological Inventory might be a useful counseling tool in the hands of a qualified professional person. Finally, it should not be overlooked that the highest correlation obtained in the study at Potlatch Forests, Inc. was .34 between years of education and Work Efficiency Ratings. This should serve to correct, or at least modify, the assumption (held by at least a few) that lumbering requires nothing more than a good physique and a willingness to work.

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